BACKGROUND

With its first case reported in Wuhan, China, in December 2019, COVID-19 quickly became a pandemic and global concern with millions of people getting infected and dying of this disease. As of February 8, 2021, more than 106 million cases were confirmed, with more than 2.31 million deaths. The world witnessed the collapse of numerous industries, rising unemployment, burdened healthcare workers, closure of schools and colleges, suspended airlines and a disrupted global supply chain. Researchers worldwide toiled day and night to develop a vaccine and within less than 12 months into the pandemic, several scientists had developed vaccines to combat this disease/virus; however, the challenge was to make these vaccines available to people around the world.

As of December 2020, there were >200 COVID-19 vaccine candidates in the development stage, of which, at least 52 candidates are currently undergoing human trials. Moreover, there are several others in the Phase 1/2 and will soon enter Phase 3 in the coming months. Typically, for a vaccine to be considered safe and effective, it must clear multiple evaluation processes, which usually require ~12 years, right from complete development, testing and approval procedures to large-scale manufacturing and availability in
the market. But, due to the rapid spread of this virus and mounting death tolls, researchers were prompted to fast-track the entire methodology, wherein they shortened the trial cycles, limited the number of participants and conducted parallel phases; all this while ensuring safety and quality standards throughout the process. Therefore, having various/several candidates in the pipeline raises chances of drawing out one or more successful efficacious vaccines.

The US, the UK, India, Russia and China are leading the global race of COVID-19 vaccine development. India has been at the forefront of this activity and played a pivotal role in developing indigenous vaccine candidates, manufacturing potential vaccines in collaboration with international peers and conducting clinical trials at an extensive scale.

**VACCINE CATEGORIES**

Vaccines, which are presently being studied for COVID-19, can be categorised into the following five groups:

1. Genetic material (DNA or RNA) based vaccines: These use one or more coronavirus’s genes to produce an immune response.

2. Vector-based vaccines: These use other viruses (e.g., adenovirus, which typically causes common cold) to deliver coronavirus genes into cells and produce an immune response.

3. Protein-based vaccines: These use a coronavirus protein or a protein fragment to produce an immune response.

4. Weakened or inactivated virus vaccines: These use a weakened or activated form of coronavirus to produce an immune response.

5. Repurposed vaccines: These are already approved and used for other diseases and are currently being tested for their role in protection against the COVID-19 virus.

**INDIA’S COVID-19 VACCINE PROGRESS**

A report by Netscribes revealed that the vaccine market in India was valued at Rs. 72.44 billion (US$ 993.6 million) in 2019 and is estimated to reach Rs. 267.31 billion (US$ 3.67 billion) by 2025, expanding at a CAGR of ~26.82% during the same period. The country can play a pivotal role, considering it hosts one of the largest vaccine manufacturing sites in the world; others too are ramping up capacities.

Indian manufacturers are proactively engaged in the development of potential COVID-19 vaccines. At present, the country has two indigenous vaccines—‘COVAXIN’, which is being developed by Bharat Biotech International Ltd. and Cadila Healthcare Ltd; and ‘COVISHIELD’ that is being manufactured by Serum Institute of India Pvt. Ltd. and developed by the University of Oxford and AstraZeneca—that were approved by the national drug regulatory body in January 2021. Besides these two Indian vaccines, other vaccines
that received emergency use authorisation (EUA) worldwide are Russia’s Sputnik V, China’s Sinovac Biotech and Sinopharm, Pfizer-BioNTech and Moderna.

India’s COVID-19 vaccination drive started on January 16, 2021. The Union Health Ministry announced that, as of February 10, 2021, India has become the fastest country in the world to vaccinate 70 lakh people in only 26 days, whereas the US took 27 days and the UK took 48 days to reach the same figures. In the first phase, vaccination would be provided (free of cost) to priority healthcare and frontline workers, who are estimated to be ~30 million, followed by people aged >50 years and people aged <50 years with co-morbidities, totalling to ~270 million for the next phase.

Moreover, India’s daily new cases have eased considerably in the last couple of months, as the number of active cases fell below the 14,000-mark in January 2021. So far, in 2021, daily new cases have averaged to ~12,000, with the national recovery rate at 97.26%, which continues to be one of the highest worldwide.

INDIAN VACCINE MAKERS

Bharat Biotech International Ltd.

Located in Hyderabad, India, Bharat Biotech manufactures vaccines and biotherapeutic products. The company supplies its products to ~65 countries and has delivered more than 3 billion doses of vaccines worldwide. It has filed 427 patents, as of 2020, and owns 140 global patents for vaccines and biotherapeutic products. Bharat Biotech is the first company in the world to develop eco-friendly recombinant Hepatitis-B vaccine, rota virus vaccine from naturally attenuated strain and typhoid conjugate vaccine. It is actively involved in the development of vaccines for COVID-19, chikungunya, rotavirus, malaria, liquid rabies and Staphylococcus Aureus. In February 2019, the company acquired Gujarat-based, Chiron Behring Vaccines Pvt. Ltd., the manufacturer of rabies vaccine.

Bharat Biotech’s COVID-19 vaccine candidate, COVAXIN, was developed in collaboration with the Indian Council of Medical Research (ICMR) and National Institute of Virology (NIV). This inactivated vaccine was developed in the company’s BSL-3 (Bio Safety Level-3) high containment facility. It received the approval from Drugs Controller General of India (DCGI) for Phase 1 and Phase 2 human clinical trials for COVAXIN.

Serum Institute of India Pvt. Ltd.

Based in Hadapsar, Pune, Serum Institute manufactures vaccines, immune-biological products and pharmaceuticals. The company uses genetic and cell-based technologies to manufacture highly specialised vaccines, which are used in the national immunisation programmes across 170 countries. Its production facilities are equipped with cutting-edge machineries, tunnel systems, high-speed vial washing systems, sealing machines, robotic arm for virus handling, cell factory and cell cube.

Serum Institute has been actively involved in the development of a potential COVID-19 vaccine. The company partnered with the UK-based AstraZeneca PLC to produce ‘COVISHIELD’ in India and invested ~Rs. 7.36 billion (US$ 100 million) to develop the
potential vaccine at Oxford University. DCGI approved the usage of COVISHIELD in January 2021.

Other Vaccine Candidates in Pipeline

Zydus Cadila
Gujarat-based Zydus Cadila announced the completion of Phase 1 and 2 clinical trials of its COVID-19 vaccine candidate, ZyCoV-D. ZyCoV-D, the plasmid DNA vaccine, was found to be safe in Phase 1 and 2 trials. In January 2021, the company announced that it will be initiating Phase 3 clinical trial with ~30,000 volunteers. On February 08, 2021, Sharvil Patel, Managing Director, Cadila Healthcare revealed that they have far more orders from various countries for jabs than its production capacity. He also stated that Zydus Cadila is setting up a manufacturing plant to produce 120 million doses of ZyCoV-D vaccine and the plant is expected to be ready by Q1 2022. In addition, the company is also exploring partnerships to expand to 60-70 million doses, with a target production capacity of 200 million doses.

Biological E
Guand Baylor College of Medicine. Phase 1 clinical trials of its COVID-19 vaccine candidate, Ad26.COV2.S, started in December 2020 and Phase 2 is expected to begin in March 2021. In August 2020, Biological E partnered with Janssen Pharmaceutica NV, the pharmaceutical unit of Johnson & Johnson, to enhance the manufacturing capacity of the drug substance required for its COVID-19 vaccine candidate. In addition, the company collaborated with the US-based Baylor College of Medicine through a licensing agreement to develop the vaccine. The license enabled the company to further develop and commercialise the recombinant protein COVID-19 vaccine candidate. The company is focusing on the transfer of technology to India to scale up manufacturing.

Gennova
HGCO19, India’s first mRNA vaccine made by Pune-based Gennova, in collaboration with Seattle-based HDT Biotech Corporation, is using bits of genetic code to cause an immune response. Gennova’s vaccine is currently in Phase 1, with Phase 2 clinical trials likely to begin in March 2021. If successful, the vaccine may be the first indigenously developed vaccine using mRNA technology that could leverage India’s existing cold chain capacity, as this vaccine is stable at 2°C to 8°C for two months.

Dr. Reddy’s Laboratories Ltd.
The ‘Sputnik-V’ vaccine candidate is being developed by Dr. Reddy’s Lab. and Gamaleya National Centre in Russia. Dr. Reddy’s had joined forces with the Russian Direct Investment Fund (RDIF) for manufacturing and distributing its vaccine in India. The vaccine has been already launched in other countries such as Pakistan and Iran. The Phase 3 trial of Sputnik-V vaccine has already begun in India and the vaccine is expected to be launched in March 2021.

AurobindoPharma Ltd.
Hyderabad-based, AurobindoPharma Ltd. collaborated with the Council of Scientific and Industrial Research (CSIR) and the US firm COVAXX to develop a COVID-19 vaccine candidate for India and the United Nations Children’s Fund agency. The COVAXX vaccine is currently undergoing early-stage trials. The vaccine requires ordinary refrigeration temperature, as compared with other vaccines, which will be beneficial for developing countries who have limited specialist cold storage chains. Aurobindo is ramping up its production facilities to produce ~480 million by June 2021, double its current capacity to produce 220 million doses.

Indian Immunologicals
Indian Immunologicals has collaborated with Griffith University of Australia to conduct exploratory research to develop a COVID-19 vaccine candidate. It will develop a live attenuated vaccine using the latest codon de-optimisation
technology. On completion of the research, the vaccine strain will be transferred to Indian Immunologicals, which will conduct clinical trials in India.

**Overview of Key Stats**

**Among Made-in-India vaccines, Bharat Biotech is approved. Cadila expected to begin Phase 3 soon**

<table>
<thead>
<tr>
<th>Vaccine Candidate</th>
<th>Sponsor</th>
<th>Est. Launch date</th>
<th>India Trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covaxin</td>
<td>Bharat Biotech</td>
<td>Jan 2021</td>
<td>Phase 3 ongoing</td>
</tr>
<tr>
<td>Zycov-D</td>
<td>Zydus Cadila</td>
<td>Jun 2021</td>
<td>Phase 2 completed</td>
</tr>
<tr>
<td>BECOV</td>
<td>Biological E/Baylor college of medicine</td>
<td>Late 2021</td>
<td>Phase 1/2 ongoing</td>
</tr>
<tr>
<td>HGCO19 (mRNA)</td>
<td>Gennova (Emcure)</td>
<td></td>
<td>Phase 1/2 ongoing</td>
</tr>
<tr>
<td>UB-612</td>
<td>Aurobindo/Covaxx</td>
<td></td>
<td>Phase 3 ongoing</td>
</tr>
</tbody>
</table>

**Global vaccines with Indian Partners**

<table>
<thead>
<tr>
<th>Vaccine Candidate</th>
<th>Global Vaccine</th>
<th>India Partner</th>
<th>Est. Launch date</th>
<th>India Trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZD1222 (Covishield)</td>
<td>AstraZeneca/Oxford</td>
<td>Serum Institute</td>
<td>Jan-21</td>
<td>Phase 2/3 completed</td>
</tr>
<tr>
<td>JNJ-78436735</td>
<td>J&amp;J</td>
<td>Biological E</td>
<td>Apr-21</td>
<td>Not started</td>
</tr>
<tr>
<td>Sputnik V</td>
<td>Gamaleya Institute, Russia</td>
<td>Hetero/Dr Reddy's</td>
<td>Apr-21</td>
<td>Phase 2/3 ongoing</td>
</tr>
<tr>
<td>NVX-CoV2373</td>
<td>Novavax</td>
<td>Serum Institute</td>
<td>Apr-21</td>
<td>Phase 2/3 start awaiting approval</td>
</tr>
<tr>
<td>Tozinameran (BNT162b2)</td>
<td>Pfizer</td>
<td>None</td>
<td>Jan-21</td>
<td>Not started</td>
</tr>
<tr>
<td>mRNA-1273</td>
<td>Moderna</td>
<td>None</td>
<td>Not known</td>
<td>Not started</td>
</tr>
</tbody>
</table>

*Source: Jefferies Report*

## STRATEGIES ADOPTED BY INDIAN PLAYERS

**Contract based manufacturing deals flourish**

As manufacturing vaccines remains an extremely challenging process and only a few players worldwide have the required expertise and capacities to meet the global demand for COVID-19 vaccines, multiple public/private partnerships are emerging across the globe to ensure wider availability of vaccines. Governments and private players are entering purchasing agreements to procure millions of doses of COVID-19 vaccines for their populations. All key players have joined hands with international associations to launch their vaccines. For e.g., Serum Institute of India signed a licensing agreement with...
AstraZeneca to supply 1 billion doses for developing countries. In August 2020, Wockhardt partnered with the UK Government to fill finish COVID-19 vaccines. In December 2020, Bharat Biotech and Ocugen, a US-based biotech company, signed an agreement to co-develop ‘Covaxin’ for the US market. Ocugen will have the US rights to the vaccine candidate.

**Ramping up manufacturing capacities**
Companies, which are working on developing a potential COVID-19 vaccine, are aiming to enhance their production capacities to fulfill their supply commitments towards domestic and international markets. In June 2020, the Serum Institute of India, spent Rs. 7 billion (US$ 100 million) on its manufacturing facility; and has further investment plans. In August 2020, the company received ~Rs. 11.25 billion (US$ 150 million) from Bill and Melinda Gates Foundation.

Aurobindo and Strides are setting up contract manufacturing facilities for COVID-19 vaccines, wherein each company can manufacture ~300-450 million doses. In addition, Biological E is conducting Phase 1/2 studies for its COVID-19 vaccine in India and will have 400-500 million doses of India-dedicated capacity upon regulatory approvals in June 2021. Once steady-state manufacturing levels are reached in 1-1.5 years, capacities across all vaccine players and contract manufacturing companies can provide ~2 billion COVID-19 vaccine doses in the country annually.

**Strengthening supply chain**
Indian vaccine manufacturers are keen on strengthening their partnership with packaging material suppliers who produce glass vials, syringes, stoppers and ancillary packaging equipment. Glass packaging material suppliers such as Gerresheimer India, Schott Kaisha, Piramal Glass and Borosil are also actively focusing on capacity addition to meet the rising demand from COVID-19 vaccine manufacturers. In addition, regulatory authorities need to ensure a seamless flow of ancillary items to domestic vaccine manufacturers with a ready formulae at an affordable price. Manufacturers are also strengthening their supply chains. In January 2021, Bharat Biotech partnered with Precisa Medicamentos, a Brazilian company, for the supply of Covaxin to Brazil.

**Improvements in cold chain infrastructure**
Vaccines need to be stored at a certain temperature and require specialised handling. India, by playing a pivotal role in global inoculation of COVID-19 vaccines, is ensuring the availability of robust end-to-end cold chain solutions. Manufacturers are partnering and collaborating with providers of cold chain facilities to ensure safe mobilisation of vaccines to more than 75 low-income developing countries.

**INDIA - A COVID-19 VACCINE MANUFACTURING HUB**

With global mass COVID-19 vaccination campaigns, there is an emerging gap between rich and poor countries in their capacity to secure sufficient vaccines for their citizens. Wealthy countries have been accused of hoarding vaccines, mostly from Pfizer-BioNTech and Moderna. This has created opportunities for India, China and to an extent Russia to cater to the developing countries.

Akhil Bery, South Asia analyst at Eurasia Group, a political risk consultancy, in a CNBC report said, “Vaccine diplomacy can be an effective use of soft power that can help New Delhi win friends and generate goodwill. India’s generosity with its neighbours can help to mend ties, whether it be with Bangladesh (which was strained due to the Citizenship Amendment Act), or with Sri Lanka,
where the Rajapaksas are known to have a pro-China tilt.” The Rajapaksas are a prominent political family in Sri Lanka, with the country’s President and Prime Minister being a part of the family.

India has the ability to manufacture >3 billion doses annually. As per the Coalition for Epidemic Preparedness Innovations (CEPI), ~2-4 billion doses of COVID-19 vaccines will be produced by global companies, where India is anticipated to capture a major share on account of its lower vaccine price as compared with its global counterparts. At present, AstraZeneca and Serum Institute of India have launched their vaccines; this action will soon be followed by Zydus Cadila, Dr. Reddy’s/Hetero and Bharat Biotech, and other challengers in the race include Biological E, Indian Immunologicals and Mynvax. An impressive pipeline of potential COVID-19 vaccines—that are being developed and tested in the country—has raised hopes across the globe.

External Affairs Minister S. Jaishankar announced that as of February 2021, India has supplied COVID-19 vaccines to 15 countries and another 25 countries are in the queue. He also added that some poor countries are being supplied vaccines on a grant basis, while some countries will have to pay the standard prices. Moreover, cost-effectiveness and negligible side-effects are the main factors that help Indian vaccines be accepted worldwide. India has received orders from other countries either on a government-to-government basis or by directly through the vaccine developers that are manufacturing doses in India. Prime Minister (PM) Narendra Modi recently expressed his support towards the mass vaccine movement that India is leading. He said, “India used to import PPE kits, masks, ventilators and testing kits from outside but today our nation is self-reliant. Today, India is ready to save humanity with two ‘Made in India’ coronavirus vaccines.”

In January 2021, Dominican Republic Prime Minister Roosevelt Skerrit appealed to PM Narendra Modi for inoculations by stating, “As we enter 2021 and persevere in our fight against COVID-19, Dominica’s population of 72,100 is in urgent need of enough doses of the Oxford-AstraZeneca vaccine. I, therefore, request, with great humility and respect, that you assist us by donating the doses we need to make our population safe (optimally 70,000 first and second doses).”

In the same month, Brazil, which has the second highest number of coronavirus cases in the world, sent a special plane to pick up Indian vaccines from Pune. In the first week of February 2021, the Indian government announced that it will supply 1 lakh vaccines to Cambodia through Serum Institute of India.

As of February 2021, Bangladesh brought 5 million doses of COVISHIELD vaccine from the Serum Institute of India. The country also received 2 million doses of COVISHIELD as a gift from India. On February 10, 2021, Canada has asked for 1 million doses of COVID-19 vaccines from the Serum Institute of India. By late 2020, Canada had sourced enough Moderna and Pfizer vaccines for its population. However, the slow rollout of both these vaccines adversely affected the country’s vaccination programme and caused the country to turn to India for vaccines.

India has sent 1 million COVID-19 vaccine doses to Nepal, 150,000 to Bhutan, 100,000 to Maldives, 100,000 to Mauritius, 50,000 to Seychelles and 1.5 million to Myanmar. The Bolivian government also signed a contract with India’s Serum Institute for the supply of 5 million doses of COVISHIELD vaccine. India is also planning to send doses to Sri Lanka, Afghanistan, Saudi Arabia and South Africa after receiving regulatory clearances from these countries.

India also is conducting training programmes for immunisation managers, cold chain officers, communication officers and data managers of the recipient countries at national and provincial levels. In addition, India is also organising several training programmes for
healthcare workers and administrators of partner countries under the Indian Technical and Economic Cooperation (ITEC) programme.

**GOVERNMENT ROADMAP**

The vaccine cold chain network in India comprises four government medical-store depots (GMSDs), 39 state vaccine stores, 123 divisional vaccine stores, 644 district stores and 22,674 community health centre/primary health centre (CHS/PHC) stores. The required vaccine arrives directly at state and division stores. ~20% of the annual requirement is supplied to GMSDs (Karnal, Chennai, Mumbai and Kolkata), where the stock is maintained for three months maximum. These depots supply the state and union territories. Usually, 80% vaccines are supplied directly to the state and/or divisional/regional vaccine stores by manufacturers/suppliers. The Union Health Secretary Rajesh Bhushan has directed state governments to record daily feedback on progress in deployment.

**Vaccine distribution chain in India**

![Vaccine distribution chain in India diagram](source: Jefferies Report)

**Vaccine Delivery and Distribution Initiatives**

Even after the development, positive results in trials and scaled up production, delivery and distribution of vaccines are paramount for the success of the potential COVID-19 vaccine. The Indian government is likely to play an instrumental role in balancing the fair and reasonable distribution of vaccines between domestic and export markets, along with prioritising the export destinations. The distribution of vaccines in a populous country such as India poses significant challenges for authorities and therefore, the Indian government has already started preparing a roadmap for the distribution of potential COVID-19 vaccine.

In order to ensure an efficient delivery mechanism, the government has formed a national expert group, which will guide the government on selection of COVID-19 vaccine candidates and population groups for immunisation; and assure availability of cold chain and other related infrastructure.

**Universal Immunisation Programme (UIP) mechanism**

The government is planning to use the UIP mechanism for COVID-19 vaccination
programme that was earlier used for numerous vaccines including BCG, oral polio and Hepatitis B. The UIP provides free vaccines for 12 vaccine-preventable diseases to beneficiaries and has played a pivotal role in boosting immunity among Indians. The Indian government has spent a substantial amount on UIP, which includes costs of vaccine, cold chains, transportation, disease surveillance and workforce/staff working in the immunisation programme. UIP is based on a digital system called eVIN, which provides real-time information on vaccine inventories across nationwide cold chain points. The government is planning to incorporate software modifications and lessons learnt from the COVID-19 Vaccine Intelligence Network (Co-WIN) platform into the UIP programme. The Co-WIN platform will support the vaccination programme by providing real-time information of vaccine stocks, storage temperature and beneficiary tracking.

**Building back-end infrastructure for vaccine administration**

The Government of India (GOI) has identified a prioritised population group consisting of 300 million people (10 million healthcare workers, 20 million frontline workers and 270 million high-risk individuals) who will be vaccinated first. Vaccination of this prioritised group is expected to take ~8-9 months. The government is creating back-end infrastructure that will be needed for an efficient vaccine administration. The government is upgrading India’s current cold chain infrastructure, as the current cold chain for the Universal Immunisation Programme (UIP), consisting of ~86k equipment and ~29k cold chain points, can handle COVID-19 vaccines only for the first 30 million people.

**POTENTIAL CHALLENGES**

A report by IIFL Securities explained that manufacturing capacity, rather than high efficacy, is expected to be the key determinant for success for Indian COVID-19 vaccine players. While both Pfizer and Moderna have reported very high efficacy levels for their COVID-19 vaccines, most vaccines under development in India are expected to demonstrate efficacy of ~60-70%, because these are based on older technology platforms (common influenza and flu vaccines that are based on legacy platforms usually have efficacy of 50-60%). The IIFL Securities report was based on interactions with some Indian COVID-19 vaccine developers who suggested that efficacy would not be the key differentiating factor for commercial success among various companies, as long as all players achieve a minimum threshold efficacy level (50-70%). This is because the COVID-19 vaccine market in India would largely be institutional/government-driven and all players should see an uptake, provided minimum threshold efficacy levels are attained.

While the government is augmenting its cold chain infrastructure, the fact that the current cold storage infrastructure for UIP can handle COVID-19 vaccines only for ~2% of India’s population, highlights the scale up challenges that lie ahead in order to achieve mass-scale vaccination in the country. To increase India’s capacity, cold storage and distribution provided by private logistics companies will also be utilised.

The IIFL securities report also suggests that with the immunisation programmes in action, there is a concern that the demand for COVID-19 treatment drugs (such as Remdesivir and Favipiravir) will decline in the Indian market in near term; this is likely to slow the business for Cipla, Cadila and Glenmark. However, given that it will take 2-2.5 years to vaccinate 70% of the Indian population and the fact that the pandemic is expected to
persist; demand for COVID-19 drugs will remain at least for the next 12 months. Moreover, managements of a few companies have stated that even post this 12-month period, 25-30% of the COVID portfolio sales can sustain.

THE WAY FORWARD...

The top four Indian COVID-19 vaccine developers, such as Serum Institute of India, Bharat Biotech, Cadila and Dr. Reddy’s, have a combined capacity to produce 1 billion annual doses for the country; of this Serum Institute of India alone accounts for 600 million doses and is likely to corner a disproportionate share of the market. The key differentiating factor for commercial success among various Indian COVID vaccine players would be their manufacturing capacities and ability to scale-up production post regulatory approvals.

Furthermore, all six vaccines, which are under clinical trials, are based on legacy technology platforms (such as adenovirus, inactivated viral vector and recombinant protein antigens) and hence, will be stable at normal storage temperatures of 2-8°C; and thereby, will eliminate the need for ultra-low cold-chain facilities.

The IIFL securities report estimates that the top four Indian vaccines can inoculate ~35% of the Indian population in 2021 and achieve ~70% herd-level immunisation in 2-2.5 years. So, for most players, COVID-19 vaccine manufacturing opportunity is expected to last only for the first 2.5 years. In India, all COVID vaccines, which are under development, comprise of 2-doses, except for Cadila’s vaccine, which comprises 3-doses; however, Cadila’s 3-dose schedule can be a hindrance for its uptake, although the Indian populace may not have a choice on the vaccine candidate, given that its administration will be controlled by the government.

Further, COVID-19 is expected to usher significant attention towards the Indian vaccine market from investors, government, institutions and regulatory agencies. Authorities are predicted to prioritise the process of procurement and distribution of vaccines. Players conducting research on COVID-19 vaccines are expected to attract sizeable funding from investors. The influx of funding in the industry is anticipated to accelerate technological advancement and innovation. Emerging biotechnology companies are likely to enter in the market by joining the race of COVID-19 vaccine development. Vaccines developed using frontier technologies such as the use of mRNA, intranasal vaccines, electroporation and nanotechnology are predicted to gain prominence. Manufacturers are realigning their innovation strategies and considering the allocation of dedicated units to conduct research on vaccine development to provide protection from novel pathogens with catastrophic potential such as COVID-19.

The demand for contract manufacturing of vaccines is expected to continue mainly driven by global biotech companies with the aspiration to enter in the market, along with large pharmaceutical companies aiming to diversify their supply chain. The Indian vaccine manufacturers, with large production capacities and technical expertise, are anticipated to benefit from the growing popularity of contract manufacturing of vaccines.

Along with boosting the research and innovation activities, the pandemic has also disrupted the routine immunisation programmes across the country, especially in Q1 2021. However, the market has started recovering and is expected to transform in terms of its strategic alignment, business model and operations in the wake of the pandemic.